High-contrast planar plasma display and its manufacture

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Abstract of **CN1289140**

The high-contrast plasma P-display is formed from glass base board, black mask, transparent electrode, bus electrode, dielectric layer and MgO layer, in which the black mask is formed in the electrode-formed zone and non-luminescent zone of glass base board surface, the transparent electrode is formed on the surface of black mask of electrode-formed zone, the bus electrode is formed on the surface of the transparent electrode, and the dielectric layer and MgO are deposited on the upper portion of glass base board in turn, and the black mask is formed from Cr/Cr2O3.Fe/Fe2O3 structure or block low-melting point glass substance, the transparent electrode is made up by using indium-tin oxide or tin oxide, the bus electrode is formed from Cr/Cu/Cr. Cr/Al/Cr structure of Ag structure and the dielectric layer is formed from lead oxide or silicon oxide, etc. material.

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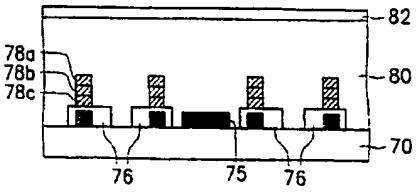
[54]发明名称 高对比等离子平面显示器及其制造方法

[57]摘要

一种高对比等离子平面显示器，其由玻璃基板、黑色掩模、透明电极、总线电极、介电层及MgO层构成；黑色掩模形成在玻璃基板表面的电极形成区域及不发光区域；透明电极形成在电极形成区域的黑色掩模表面。总线电极形成在透明电极的表面；介电层及MgO层依序沉积在玻璃基板上方；黑色掩模由Cr/Cr_2O_3、Fe/Fe_2O_3结构或黑色低融点玻璃物质构成；透明电极由铟锡氧化物或氧化锡所构成；总线电极由Cr/Cu/Cr、Cr/Al/Cr结构或Ag结构构成。介电层由氧化铅或氧化硅等物质构成。



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权 利 要 求 书

1. 一种等离子平面显示器的制造方法，其特征在于，它包括下列步骤:

(a) 提供一玻璃基板;

(b) 在该玻璃基板上形成一遮光掩模，遮光掩模具有一遮光掩模顶面;

(c) 在该玻璃基板上紧邻该遮光掩模处形成一透明电极，该透明电极具有一侧向延伸区，该侧向延伸区覆盖于该遮光掩模顶面上;

(d) 在该透明电极的侧向延伸区上形成一总线电极，如此使该总线电极底面受到该遮光掩模遮蔽而减少反光。

2. 如权利要求 1 所述的等离子平面显示器的制造方法，其特征在于，在步骤(b)中，同时在该玻璃基板上形成一黑色掩模，该黑色掩模可用以隔离该玻璃基板上不同的影像像素。

3. 如权利要求 1 所述的等离子平面显示器的制造方法，其特征在于，在步骤(d)之后，更包括步骤: (e)形成一介电层以覆盖在该玻璃基板、遮光掩模、透明电极及总线电极上。

4. 如权利要求 3 所述的等离子平面显示器的制造方法，其特征在于，在步骤(e)之后，更包括步骤: (f)在该介电层表面形成一保护层。

5. 一种等离子平面显示器的制造方法，其特征在于，它包括下列步骤:

(a) 提供一玻璃基板;

(b) 在该玻璃基板上形成一遮光掩模，该遮光掩模具有一遮光掩模侧壁与一遮光掩模顶面;

(c) 在该玻璃基板上形成一透明电极，该透明电极具有一透明电极侧壁，该透明电极侧壁与该遮光掩模侧壁相邻接，且该透明电极侧壁的高度大于该遮光掩模侧壁的高度，如此使该透明电极侧壁具有一外露部分;

(d) 在该遮光掩模顶面形成一总线电极，且该总线电极与该透明电极侧壁的外露部分相导通，如此使该总线电极底面受到该遮光掩模遮蔽而减少反光。

6. 如权利要求 5 所述的等离子平面显示器的制造方法，其特征在于，在步骤(b)中，同时在该玻璃基板上形成一黑色掩模，该黑色掩模可用以隔离该玻璃基板上不同的影像像素。

7. 如权利要求 5 所述的等离子平面显示器的制造方法，其特征在于，在

步骤(d)之后，更包括步骤：(e)形成一介电层以覆盖在该玻璃基板、遮光掩模、透明电极及总线电极上。

8. 如权利要求 7 所述的等离子平面显示器的制造方法，其特征在于，在步骤(e)之后，更包括步骤(f)：在该介电层表面形成一保护层。

9. 一种等离子平面显示器的制造方法，其特征在于，它包括下列步骤：

(a) 提供一玻璃基板；

(b) 在该玻璃基板上形成一遮光掩模，该遮光掩模具有一遮光掩模侧壁与一遮光掩模顶面；

(c) 在该玻璃基板上形成一透明电极，该透明电极具有一透明电极侧壁与一透明电极顶面，该透明电极侧壁与该遮光掩模侧壁相邻接；

(d) 在该遮光掩模顶面与该透明电极顶面的一部分形成一总线电极，且该总线电极与该透明电极顶面的一部分相导通，如此使该总线电极底面受到该遮光掩模遮蔽而减少反光。

10. 如权利要求 9 所述的等离子平面显示器的制造方法，其特征在于，在步骤(b)中，同时在该玻璃基板上形成一黑色掩模，该黑色掩模可用以隔离该玻璃基板上不同的影像像素。

11. 如权利要求 9 所述的等离子平面显示器的制造方法，其特征在于，在步骤(d)之后，更包括步骤(e)：形成一介电层以覆盖在该玻璃基板、遮光掩模、透明电极及总线电极上。

12. 如权利要求 11 所述的等离子平面显示器的制造方法，其特征在于，在步骤(e)之后，更包括步骤：(f)在该介电层表面形成一保护层。

13. 一种等离子显示器，它包括一玻璃基板、一透明电极与一总线电极；该透明电极形成在该玻璃基板上，且该总线电极与该透明电极导通；其特征在于，该总线电极与该玻璃基板之间形成有一遮光掩模，如此使该总线电极底面受到该遮光掩模遮蔽而减少反光。

14. 如权利要求 13 所述的等离子平面显示器，其特征在于，该遮光掩模具有一遮光掩模顶面，该透明电极具有一侧向延伸区，该侧向延伸区覆盖于该遮光掩模顶面上，该总线电极位于该透明电极的侧向延伸区上。

15. 如权利要求 13 所述的等离子平面显示器，其特征在于，该遮光掩模具有一遮光掩模侧壁与一遮光掩模顶面，该透明电极具有一透明电极侧壁，该透明电极侧壁与该遮光掩模侧壁相邻接，且该透明电极侧壁的高度大于该

遮光掩模侧壁的高度，该总线电极形成在该遮光掩模顶面上，如此使该透明电极侧壁具有一外露部分，而该总线电极与该透明电极侧壁的外露部分相导通。

16. 如权利要求 13 所述的等离子平面显示器，其特征在于，该遮光掩模具有一遮光掩模侧壁与一遮光掩模顶面，该透明电极具有一透明电极侧壁与一透明电极顶面，该透明电极侧壁与该遮光掩模侧壁相邻接，而该总线电极形成在该遮光掩模顶面与该透明电极顶面的一部分上，该总线电极与该透明电极顶面的一部分相导通。

17. 如权利要求 13 所述的等离子平面显示器，其特征在于，该遮光掩模是 Cr/Cr_2O_3 结构。

18. 如权利要求 13 所述的等离子平面显示器，其特征在于，该遮光掩模是 Fe/Fe_2O_3 结构。

19. 如权利要求 13 所述的等离子平面显示器，其特征在于，该遮光掩模是由黑色低融点玻璃物质所构成。

20. 如权利要求 13 所述的等离子平面显示器，其特征在于，该总线电极是 Ag 结构。

21. 如权利要求 20 所述的等离子平面显示器，其特征在于，该介电层由氧化铅及氧化硅等物质所构成。

22. 如权利要求 20 所述的等离子平面显示器，其特征在于，它更包括一保护层，形成在该介电层表面。

23. 如权利要求 22 所述的等离子平面显示器，其特征在于，该保护层为 MgO 。

说　明　书

高对比等离子平面显示器及其制造方法

本发明涉及一种显示器及其制造方法，且特别涉及一种高对比等离子平面显示器及其制造方法。

等离子平面显示器(PDP)使用气体电弧(Arc)所放射的紫外线辐射来激发红色(R)、绿色(G)、蓝色(B)的磷光物质，进而得到可见光。请参考图 1A 及 1B 所示等离子平面显示器的电极结构及其表面放电状态，如图所示，电极会分别排列在两片玻璃基板 1 、 2 的垂直及水平镶条所构成的矩阵上。一组电极是用来写入显示资料的定址电极 3(Address electrode)，另一组电极则是用来放电及实际显示的显示电极 4(Display electrode)。定址电极由条状栅栏 5 所分隔，红色、绿色、蓝色的磷光物质则镀在玻璃基板上并覆盖定址电极。两片玻璃基板 1 、 2 彼此结合，玻璃基板间的缝隙则充满氖和氙的混合气体以构成显示板。每个定址电极 3 与显示电极 4 的交会处是一个图素，资料写入定址及显示电极对所放出的电荷则转移到显示板上并在显示电极间放电。显示电极间放电的强度用来控制放射光的强度，进而能够显示全彩的符号、图形、影像。

在等离子平面显示器中，亮度(Brightness)及对比度(Contrast)均是极重要的特性。对比的定义是亮准位及暗准位的比值，如图 2 所示。由于操作方式的关系，等离子平面显示器即使在全黑状态下亦会有一点点背景辐射。因此，暗室(Dark-room)对比的定义就是显示光强度(Ld)及背景辐射(Lb)的比值:

暗室对比 = Ld/Lb

暗室对比可通过增加显示光强度或减少背景辐射来改善。但是，若增加显示光强度却不同时减少背景辐射，则较亮的黑准位将会使画面像是通过毛玻璃来看一样。

另外，在具有周遭光线(如室内照明)的环境下，来自磷光物质及玻璃表面的反射光(Lref)同时会使显示光强度 Ld 及背景辐射 Lb 增加。因此，若入射的环境光强度为 Lin 且玻璃基板的表面反射系数为α，则亮室(Light-room)

对比的定义可修正为:

亮室对比 = (Ld + Lref)/(Lb + Lref)

Lref = αLin

由上述可知，在增加暗室及亮室对比的过程中，降低背景辐射均是不可或缺的要素。

因此，有部分作法便是将不透明黑色掩模(BM)导入等离子平面显示器的前板中，使其覆盖在等离子平面显示器的不发光区域上，藉以减低反射光强度并改善亮室对比。

请参考图 3A 至 3G，此即将黑色掩模(BM)导入等离子平面显示器的前板中，藉以改善暗室及亮室对比的一个例子。

在这个例子中，首先提供一个玻璃基板 10，如图 3A 所示。然后，在玻璃基板 10 表面的电极形成区域形成透明电极 12，如图 3B 所示。透明电极 12 通常是由铟锡氧化物(Indium Tin oxide)所构成。然后，在透明电极 12 表面形成总线电极 14(Bus electrode)，如图 3C 所示。总线电极 14 通常是由 Cr/Cu/Cr 结构或 Cr/Al/Cr 结构所构成。然后，在整个玻璃基板 10(包括总线电极 14)表面再沉积一介电层 16、并将介电层 16 予以平坦化，如图 3D 所示。然后，在介电层 16 表面对应于等离子平面显示器的不发光区域定义黑色掩模 18，如图 3E 所示，黑色掩模 18 通常亦是由黑色低融点玻璃物质所构成。然后，在介电层 16 表面对应于等离子平面显示器的显示区域四周形成玻璃胶 20，如图 3F 所示。然后，在介电层 16 露出的表面再形成 MgO 层 22，如图 3G 所示。

请参考图 4A 至 4F，此即将黑色掩模(BM)导入等离子平面显示器的前板中，藉以改善亮室对比的另一个例子。

在这个例子中，首先提供一玻璃基板 30，如图 4A 所示。然后，在玻璃基板 30 表面的电极形成区域形成透明电极 32，如图 4B 所示，透明电极 32 通常是由铟锡氧化物(Indium Tin oxide)所构成。然后，同时在透明电极 32 表面形成总线电极 34(Bus electrode)，及在等离子平面显示器的不发光区域形成黑色掩模 36，如图 4C 所示。然后，在整个玻璃基板 30(包括透明电极 32、总线电极 34、黑色掩模 36)表面再形成一介电层 38，并将介电层 38 予以平坦化，如图 4D 所示。然后，在介电层 38 表面对应于等离子平面显示器的显示区域四周形成玻璃胶 40，如图 4E 所示。然后，在介电层 38 表面再形成

MgO 层 42，如图 4F 所示。

请参考图 5A 至 5H，此即将黑色掩模(BM)导入等离子平面显示器的前板中，藉以改善亮室对比的再一个例子。

在这个例子中，首先提供一玻璃基板 50，如图 5A 所示。然后，在玻璃基板 50 表面的电极形成区域形成透明电极 52，如图 5B 所示，透明电极 52 通常是由铟锡氧化物(Indium Tin oxide)所构成。然后，在透明电极 52 表面形成总线电极 54(Bus electrode)，如图 5C 所示，总线电极 54 通常是由 Cr/Cu/Cr 结构或 Cr/Al/Cr 结构所构成。然后，在整个玻璃基板 50(包括总线电极 54)表面再形成一介电层 56、并将介电层 56 予以平坦化，如图 5D 所示。然后，在介电层 56 表面对应于等离子平面显示器的不发光区域再形成黑色掩模 58，如图 5E 所示，黑色掩模 58 通常亦是由黑色低融点玻璃物质所构成。然后，在介电层 56(包括黑色掩模 58)表面再形成另一介电层 60、并将介电层 60 予以平坦化，如图 5F 所示。然后，在介电层 60 表面对应于等离子平面显示器的显示区域四周形成玻璃胶 62，如图 5G 所示。然后，在介电层 60 表面再形成 MgO 层 64，如图 5H 所示。

在上述三个例子中，黑色掩模 18、36、58 若是直接由 Cr/Cu/Cr 结构或 Cr/Al/Cr 结构所构成，可能会有高达 60 % 的表面反射系数。

有鉴于此，本发明的一个目的就是提供一种高对比等离子平面显示器及其制造方法，可降低黑色掩模的表面反射系数，进而降低反射光强度并改善亮室对比。

本发明的另一个目的就是提供一种高对比等离子平面显示器及其制造方法，在总线电极下方亦形成有黑色掩模，相比于传统结构，可增加黑色掩模覆盖面积，可进一步降低等离子平面显示器的反射光强度。

本发明的又一个目的就是提供一种高对比等离子平面显示器及其制造方法，可在不增加制程步骤及成本的前提下，达到降低反射光强度及改善亮室对比的效果。

本发明的目的是这样实现的，即提供一种等离子平面显示器的制造方法，它包括下列步骤:

(a) 提供一玻璃基板;

(b) 在该玻璃基板上形成一遮光掩模，遮光掩模具有一遮光掩模顶面;

(c) 在该玻璃基板上紧邻该遮光掩模处形成一透明电极，该透明电极具

有一侧向延伸区，该侧向延伸区覆盖于该遮光掩模顶面上；

(d) 在该透明电极的侧向延伸区上形成一总线电极，如此使该总线电极底面受到该遮光掩模遮蔽而减少反光。

本发明也提供一种等离子平面显示器的制造方法，它包括下列步骤：

(a) 提供一玻璃基板；

(b) 在该玻璃基板上形成一遮光掩模，该遮光掩模具有一遮光掩模侧壁与一遮光掩模顶面；

(c) 在该玻璃基板上形成一透明电极，该透明电极具有一透明电极侧壁，该透明电极侧壁与该遮光掩模侧壁相邻接，且该透明电极侧壁的高度大于该遮光掩模侧壁的高度，如此使该透明电极侧壁具有一外露部分；

(d) 在该遮光掩模顶面形成一总线电极，且该总线电极与该透明电极侧壁的外露部分相导通，如此使该总线电极底面受到该遮光掩模遮蔽而减少反光。

本发明另提供一种等离子平面显示器的制造方法，它包括下列步骤：

(a) 提供一玻璃基板；

(b) 在该玻璃基板上形成一遮光掩模，该遮光掩模具有一遮光掩模侧壁与一遮光掩模顶面；

(c) 在该玻璃基板上形成一透明电极，该透明电极具有一透明电极侧壁与一透明电极顶面，该透明电极侧壁与该遮光掩模侧壁相邻接；

(d) 在该遮光掩模顶面与该透明电极顶面的一部分形成一总线电极，且该总线电极与该透明电极顶面的一部分相导通，如此使该总线电极底面受到该遮光掩模遮蔽而减少反光。

本发明还提供一种等离子显示器，它包括一玻璃基板、一透明电极与一总线电极；该透明电极形成在该玻璃基板上，且该总线电极与该透明电极导通；该总线电极与该玻璃基板之间形成有一遮光掩模，如此使该总线电极底面受到该遮光掩模遮蔽而减少反光。

本发明的优点在于，由上述方法得到的等离子平面显示器会在不发光区域及电极形成区域下方同时覆盖有黑色掩模，相比于传统结构，可增加黑色掩模覆盖面积，进而降低反射光强度及改善亮室对比。

为让本发明的上述和其他目的、特征和优点能更明显易懂，下文特举一较佳实施例，并配合附图作详细说明如下：

图 1A 是现有等离子平面显示器的三电极结构图;

图 1B 是图 1A 所示等离子平面显示器的表面放电状态图;

图 2 是说明等离子平面显示器的对比的示意图;

图 3A 至 3G 是一种将黑色掩模导入等离子平面显示器的前板以改善亮室对比的制造流程图;

图 4A 至 4F 是另一种将黑色掩模导入等离子平面显示器的前板以改善亮室对比的制造流程图;

图 5A 至 5H 是再一种将黑色掩模导入等离子平面显示器的前板以改善亮室对比的制造流程图;

图 6A 至 6F 是本发明等离子平面显示器的第一实施例的制造流程图;

图 7A 至 7C 是本发明等离子平面显示器的第二实施例的制造流程图;

图 8A 至 8C 是本发明等离子平面显示器的第三实施例的制造流程图。

由于黑色掩模的表面反射系数会直接影响到亮室对比(Light-room contrast)的好坏。相比于直接以 Cr/Cu/Cr 结构或 Cr/Al/Cr 结构所构成的传统黑色掩模，本发明利用 Cr/Cr_2O_3 结构或 Fe/Fe_2O_3 结构所构成的黑色掩模，其表面反射系率可以维持在 20 % 以下。

图 6A 至 6F 即是本发明等离子平面显示器的第一实施例的制造流程图。

首先，如图 6A 所示，提供一玻璃基板 70，并在玻璃基板 70 的表面形成黑色掩模层 72。在这个实施例中，黑色掩模层 72 可以在玻璃基板 70 表面依次溅镀(Sputter)1K-2K 埃的 Cr/Cr_2O_3 结构或 Fe/Fe_2O_3 结构。

接着，如图 6B 所示，在黑色掩模层 72 表面定义一层光致抗蚀剂 74，并藉由半导体制程的光罩(Mask)对预定形成遮光掩模 73 的区域 A 及预定形成黑色掩模 75 的区域 B 进行曝光，藉以硬化相对应于区域 A、B 的光致抗蚀剂 74，然后再利用显影步骤去除区域 A、B 以外的光致抗蚀剂。接着，如图 6C 所示，利用光致抗蚀剂 74 为掩模及 Cr-7 为蚀刻反应液体(Etchant)，蚀刻未被残余光致抗蚀剂 74 保护的掩模层 72，使玻璃基板 70 表面的掩模层 72 同时只剩下区域 A 的遮光掩模 73 及区域 B 的黑色掩模 75，且该遮光掩模 73 具有遮光掩模顶面 77。此处所揭示者为最佳实施例，因此遮光掩模 73 与黑色掩模 75 系同时形成。事实上，本步骤亦可先只形成遮光掩模 73；而稍后再以额外的光罩与微影步骤来加以定义形成黑色掩模 75。

接着，如图 6D 所示，在等离子平面显示器表面电极形成区域 A 上的遮

光掩模 73 表面形成一层透明电极 76，该透明电极 76 具有一侧向延伸区 79，该侧向延伸区 79 覆盖于该遮光掩模顶面 77 上。在这个实施例中，透明电极 76 可以先在定义图案后的黑色掩模 75 及遮光掩模 73 上溅镀一层厚约 1500 埃的铟锡氧化物(ITO)；然后再利用微影步骤(曝光、显影、蚀刻)定义这层铟锡氧化物(可使用 $FeCl_3$ + HCl 为蚀刻反应液体进行蚀刻以得到)，进而去除黑色掩模 75 表面的铟锡氧化物。

接着，如图 6E 所示，在该透明电极 76 的侧向延伸区 79 上形成总线电极 78(Bus electrode)，以使该总线电极底面 81 受到该遮光掩模 73 遮蔽而减少反光。在这个实施例中，总线电极 78 可以依次在透明电极 76 对应于遮光掩模 73 的上方溅镀厚约 1K ~ 2K 埃的 Cr 层 78a、厚约 2 ~ 3μm 的 Cu(Al)层 78b、厚约 1K ~ 2K 埃的 Cr 层 78c；然后再以微影步骤蚀刻定义这三层金属 78a 至 78c，藉以在透明电极 76 表面形成所要的总线电极 78。

接着，如图 6F 所示，在黑色掩模 75、透明电极 76、遮光掩模 73、总线电极 78 上覆盖一层厚约 30μm 的介电层 80(如氧化铅及氧化硅)，并在介电层 80 表面沉积一层厚约 5000 ~ 10000 埃的保护层 82(如氧化镁层)，藉以完成整个等离子显示器结构。

本发明等离子平面显示器的第二实施例的制造流程的前三个步骤相同于如图 6A 至 6C 所示的第一实施例，但图 6D 至 6F 修正为图 7A 至 7C。

如图 7A 所示，在玻璃基板 70 表面上的遮光掩模 73 具有遮光掩模侧壁 85 与遮光掩模顶面 87。此时，在该玻璃基板 70 上形成一透明电极 76，该透明电极 76 具有透明电极侧壁 91，该透明电极侧壁 91 与该遮光掩模侧壁 85 相邻接，且该透明电极侧壁 91 的高度大于该遮光掩模侧壁 85 的高度，如此使该透明电极侧壁 91 具有外露部分 93；本步骤中的透明电极 76 的制程和条件与图 6D 所示的第一实施例相似。

接着，如图 7B 所示，在该遮光掩模顶面 87 形成一总线电极 78，且该总线电极 78 与该透明电极侧壁 91 的外露部分 93 相导通，如此使该总线电极底面 81 受到该遮光掩模 73 遮蔽而减少反光；本步骤中的总线电极 78 的制程和条件与图 6E 所示的第一实施例相似。

接着，如图 7C 所示，在透明电极 76、遮光掩模 73、黑色掩模 75、总线电极 78 上覆盖介电层 80，并在介电层 80 表面沉积保护层 82；本步骤的制程和条件与图 6F 所示的第一实施例相似。

本发明等离子平面显示器的第三实施例的制造流程的前三个步骤相同于如图 6A 至 6C 所示的第一实施例，但图 6D 至 6F 修正为图 8A 至 8C 。

如图 8A 所示，在玻璃基板 70 表面上的遮光掩模 73 具有遮光掩模侧壁 85 与遮光掩模顶面 87 。此时，在该玻璃基板 70 上形成一透明电极 76，该透明电极 76 具有透明电极侧壁 91 与透明电极顶面 95，该透明电极侧壁 91 与该遮光掩模侧壁 85 相邻接; 本步骤中的透明电极 76 的制程和条件与图 6D 所示的第一实施例相似。

接着，如图 8B 所示，在该遮光掩模顶面 87 及透明电极顶面 95 的一部分形成一总线电极 78，且该总线电极 78 与该透明电极顶面 95 的一部分相导通，如此使该总线电极底面 81 大部分受到该遮光掩模 73 遮蔽而减少反光; 本步骤中的总线电极 78 的制程和条件与图 6E 所示的第一实施例相似。

接着，如图 8C 所示，在透明电极 76 、遮光掩模 73 、黑色掩模 75 、总线电极 78 上覆盖介电层 80，并在介电层 80 表面沉积保护层 82; 本步骤的制程和条件与图 6F 所示的第一实施例相似。

综上所述，本发明提供一种高对比等离子平面显示器及其制造方法，其可降低黑色掩模的表面反射系数，进而降低反射光强度并改善亮室对比。

另外，本发明提供一种高对比等离子平面显示器及其制造方法，其同时在不发光区域及总线电极下方形成有黑色掩模，相比于传统结构，可增加黑色掩模覆盖面积，可进一步降低等离子平面显示器的反射光强度。

再者，本发明提供一种高对比等离子平面显示器及其制造方法，其可以在不增加制程步骤及成本的前提下，达到降低反射光强度及改善亮室对比的效果。

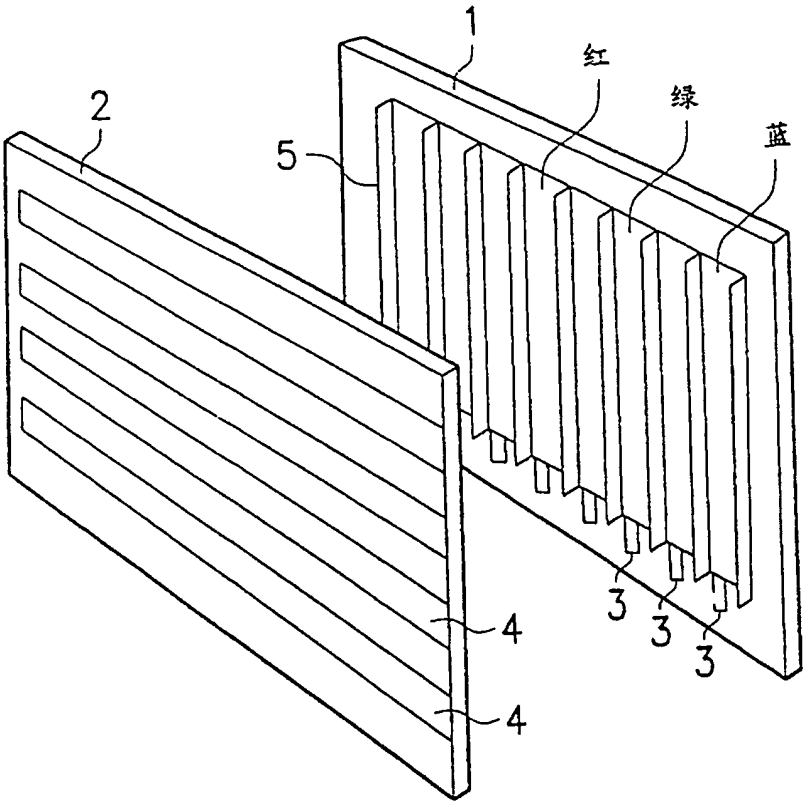

图 1A

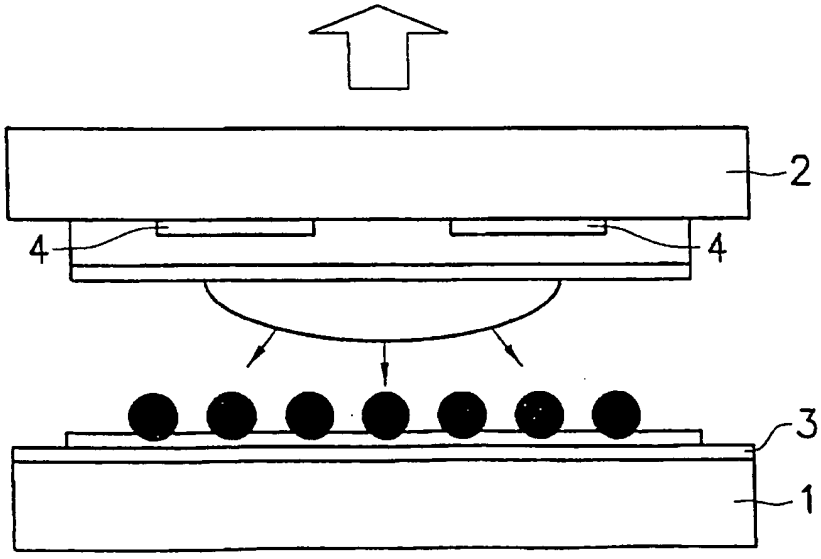

图 1B

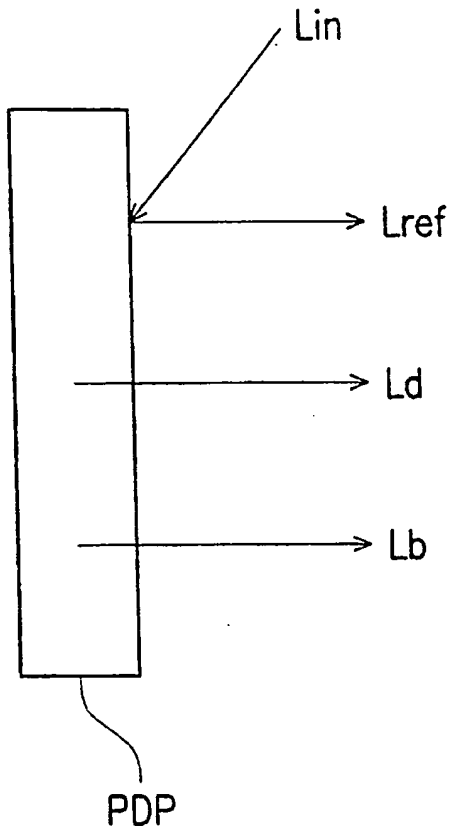

图 2

图 3A

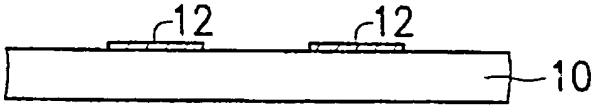

图 3B

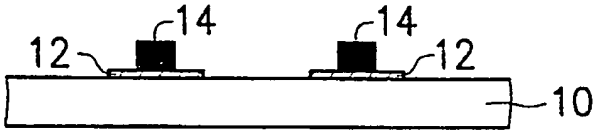

图 3C

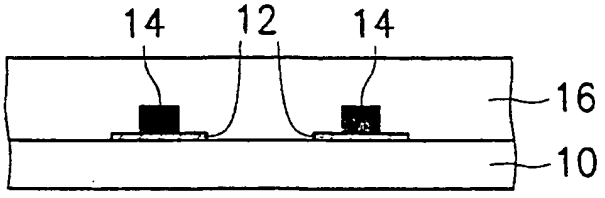

图 3D

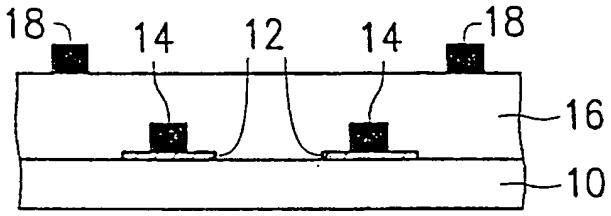
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图 3E

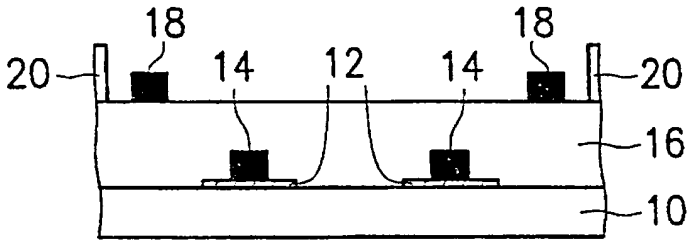
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图 3F

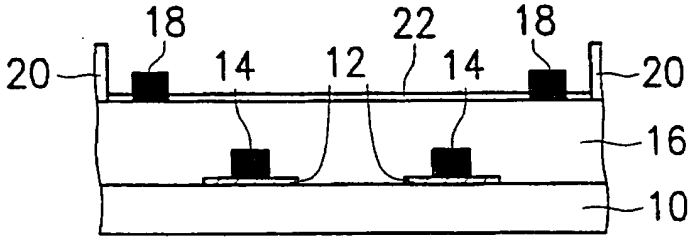
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图 3G

图 4A

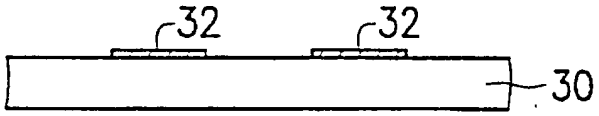

图 4B

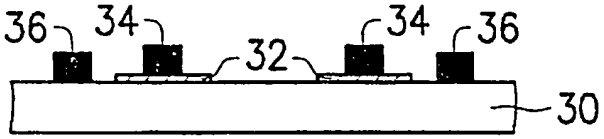

图 4C

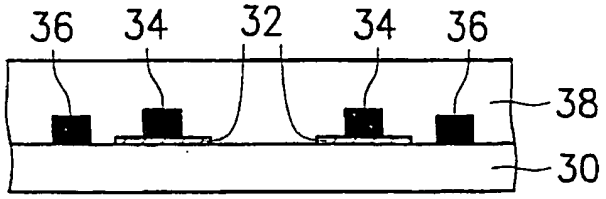

图 4D

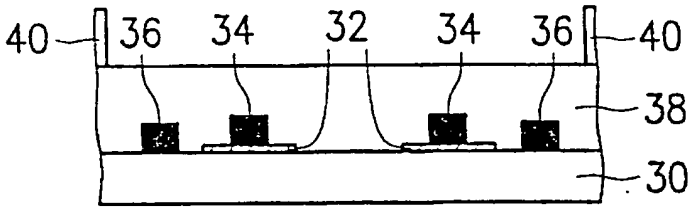

图 4E

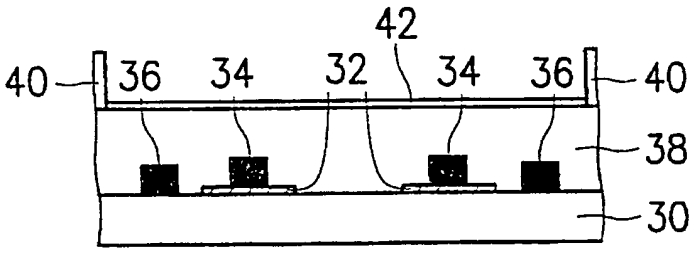

图 4F

图 5A

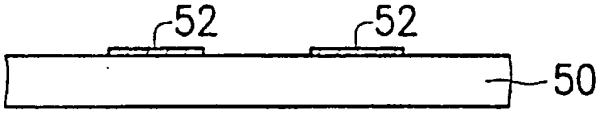

图 5B

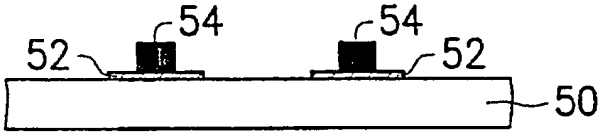

图 5C

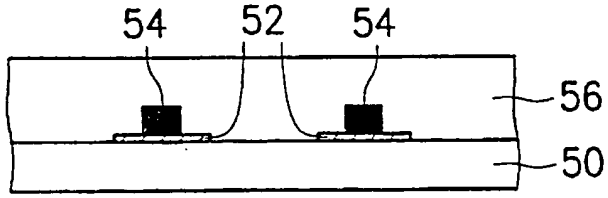

图 5D

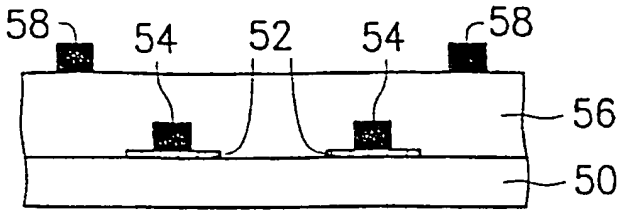

图 5E

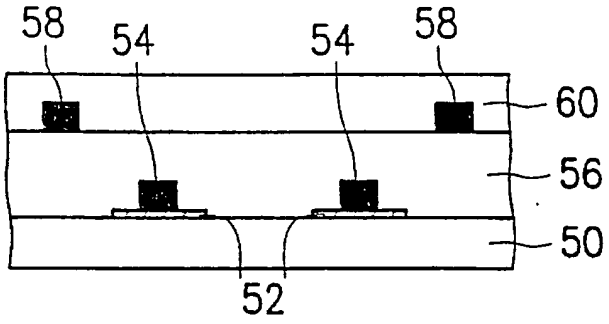

图 5F

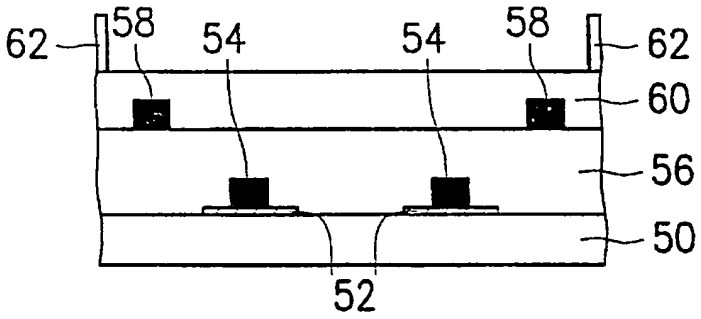

图 5G

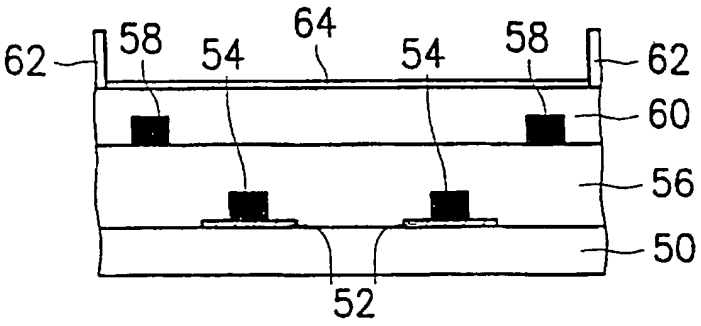

图 5H

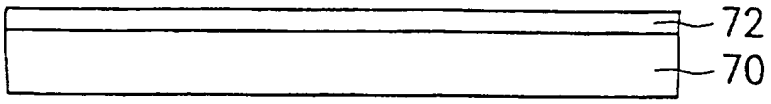

图 6A

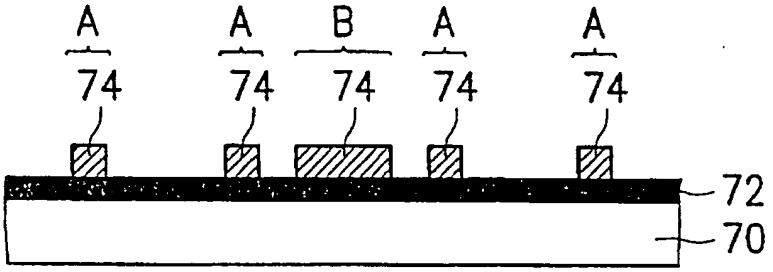

图 6B

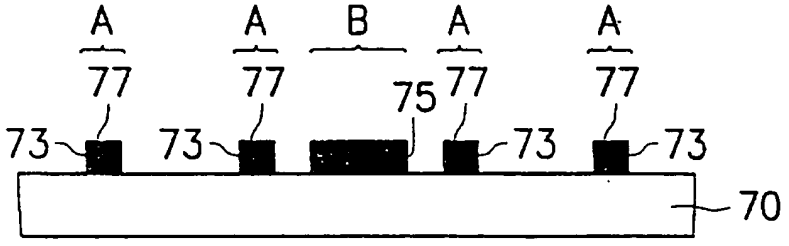

图 6C

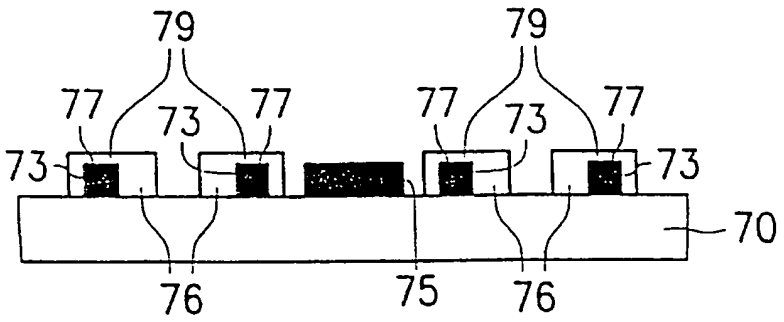
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图 6D

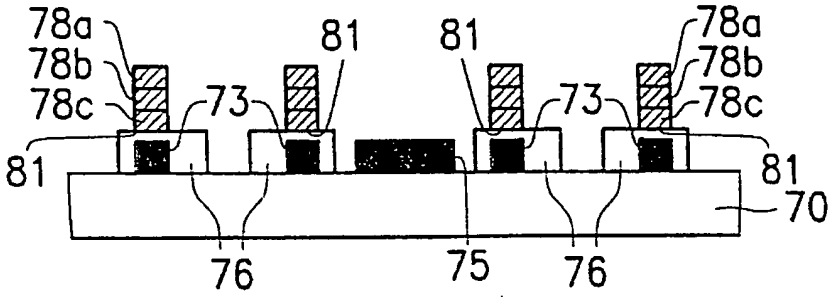

78a
78b
78c
81
81
78a
78b
78c
73
73
81
81
70
76
75
76

图 6E

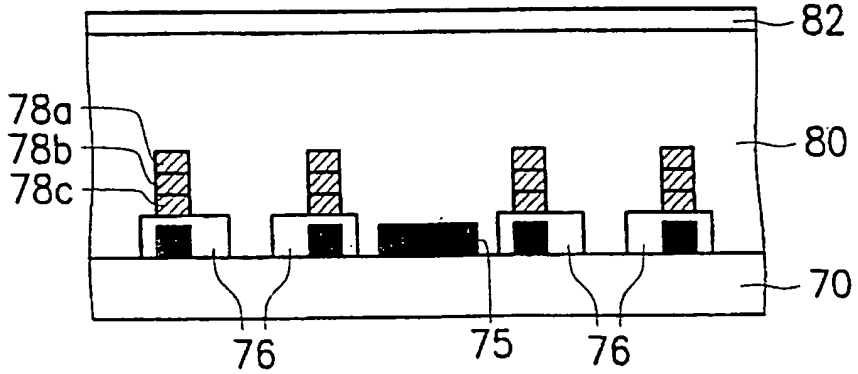
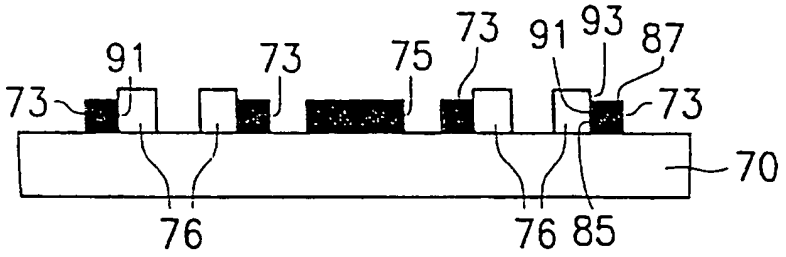

82
78a
78b
78c
80
70
76
75
76

图 6F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73
75
73
91
93
87
73
73
70
76
76
85

图 7A

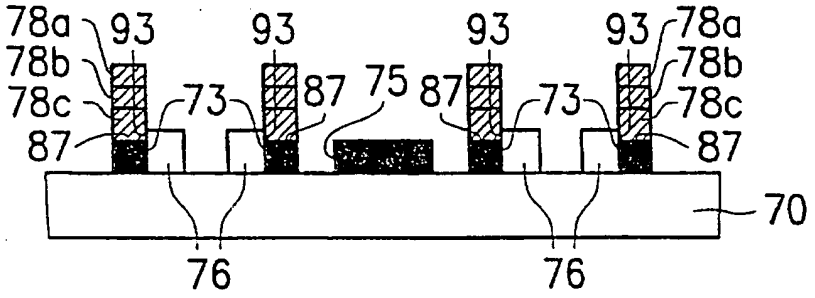
78a
78b
78c
87
93
93
93
93
78a
78b
78c
87
73
87
75
87
73
70
76
76

图 7B

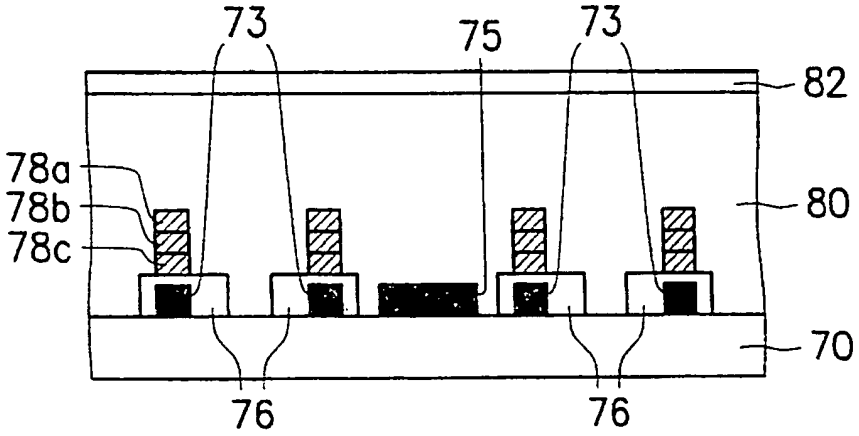
73
75
73
82
78a
78b
78c
80
70
76
76

图 7C

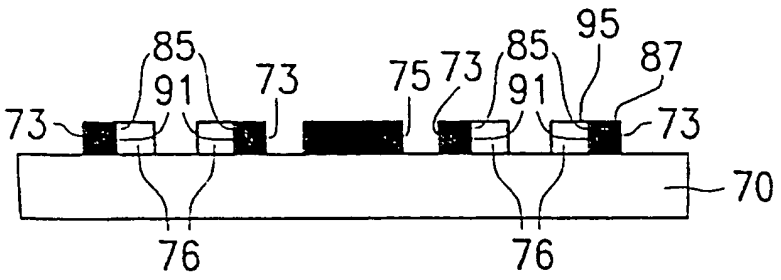
85
91
73
75
73
85
91
95
87
73
73
70
76
76

图 8A

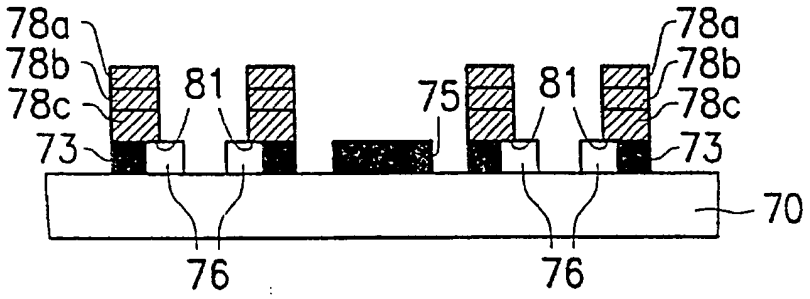
78a
78b
78c
73
81
75
81
78a
78b
78c
73
70
76
76

图 8B

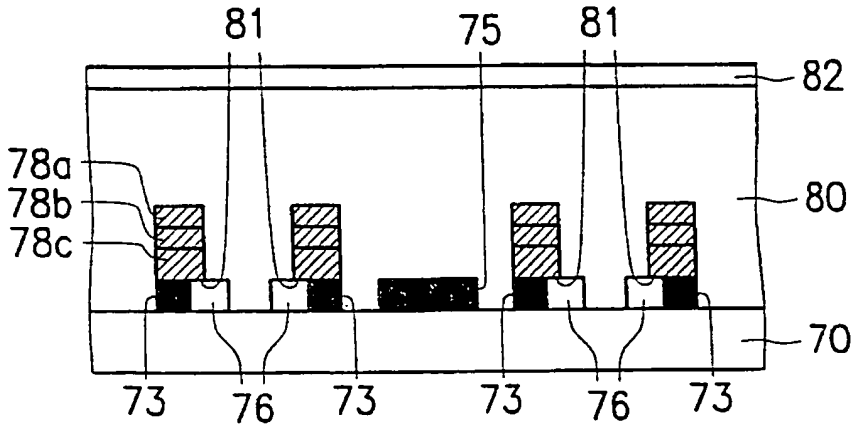
81
75
81
82
78a
78b
78c
80
70
73
76
73
73
76
73

图 8C

A PLASMA DISPLAY PANEL WITH HIGH CONTRAST AND MANUFACTURING METHOD THEREOF

Field of the Invention

The present invention relates to a display and manufacturing method thereof, and more particularly, to a plasma display panel with high contrast and manufacturing method thereof.

Background of the Prior Art

Plasma display panel (PDP) generates visible lights by exciting red (R), green (G), and blue (B) phosphor, with the ultraviolet rays generated by gas discharge arc. Figs.1A and 1B show a structure of the electrodes of a plasma display panel and the discharge status on the surface. As shown in Figs.1A and 1B, electrodes are arranged on the matrix constructed by the vertical and horizontal stripes on two glass substrates 1 and 2, respectively. One group of electrodes are address electrodes 3 for writing the information to be displayed, and the other group of electrodes are display electrodes 4 for discharging and actually displaying. Address electrodes are insulated via stripe type barrier ribs 5. Red, green, and blue phosphor materials are plated on the glass substrates so as to cover the address electrodes. The two glass substrates 1 and 2 are combined with each other. The gap between the glass substrates is filled with mixed gas of neon and xenon so as to form a display panel. A pixel is formed at the crossing point of each address electrode 3 and a display electrode 4. The charges discharged from the pair of electrodes for information writing addressing and display are transferred to the display panel and discharge between the display electrodes. The discharging intensity between the display electrodes is used to control the intensity of the emitted light, and therefore allowing it to display characters, graphics and pictures with full color.

In the plasma display panel, both the brightness and the contrast are essential characteristics. As shown in Fig. 2, the contrast is defined as the ratio between bright level and dark level. Due to the operation mode, a plasma display panel may present a little background radiation even in a totally dark condition. Accordingly, the

dark-room contrast is defined as the ratio between the luminous intensity for display (Ld) and the background radiation (Lb).

Dark-room contrast = Ld/Lb

Dark-room contrast may be improved by increasing the luminous intensity for display or reducing the background radiation. However, if the luminous intensity for display is increased but the background radiation is not reduced at the same time, the black level that is relatively bright may make a picture look like being viewed behind a sponge glass.

Additionally, under the environment with ambient light, such as interior illumination, the reflected lights (Lref) from both the phosphor and the surface of the glass may increase the luminous intensity for display Ld and the background radiation Lb. Accordingly, if the intensity of the incident ambient light is Lin and the reflection factor of the surface of the glass substrate is α, the contrast of a light-room may be defined as follows:

Light-room contrast=(Ld+Lref) / (Lb+Lref)

Lref= α Lin

As can be seen, both in the process for increasing the dark-room and light-room contrast, it is essential to reduce the background radiation.

Therefore, one method is to introduce non-transparent black masks (BM) into the front panel of a plasma display panel and make it cover on the non-luminance area of the plasma display panel, so as to reduce the intensity of reflected light and improve the light-room contrast.

Fig. 3A through 3G illustrates an example in which black masks BM are introduced into the front panel of a plasma display panel for improving the dark-room and light-room contrast.

As shown in Fig. 3A, in this example, a glass substrate 10 is provided first. Afterwards, as shown in Fig. 3B, transparent electrodes 12 are formed on the electrode forming area on the surface of the glass substrate 10. Transparent electrodes 12 are typically made of Indium Tin oxide. Thereafter, bus electrodes 14 are formed on the surfaces of the transparent electrodes 12, as shown in Fig. 3C. Bus electrodes 14 are typically formed in a structure of Cr/Cu/Cr or a structure of Cr/Al/Cr. Then, a

dielectric layer 16 is deposited on the entire surface of the glass substrate 10 including the bus electrodes 14, and then is smoothed, as shown in Fig. 3D. Afterwards, black masks 18, which are typically made of black glass material with low melting point, are defined on the surface of the dielectric layer 16 which correspond to the non-luminance areas of the plasma display panel, as shown in Fig. 3E. Then, glass cements 20 are formed around the surface of the dielectric layer 16 corresponding to the display area of the plasma display panel. Then, as shown in Fig. 3G, an MgO layer 22 is formed on the exposed area of the dielectric layer 16.

Figs. 4A through 4F illustrates another example in which black masks BM are introduced into the front panel of a plasma display panel for improving the dark-room and light-room contrast.

As shown in Fig. 4A, in this example, a glass substrate 30 is provided first. As shown in Fig. 4B, transparent electrodes 32 are then formed on the electrode forming area on the surface of the glass substrate 30. Transparent electrodes 32 are typically made of Indium Tin oxide. Thereafter, bus electrodes 34 are formed on the surfaces of transparent electrodes 32 while black masks 36 are formed on the non-luminance areas of the plasma display panel, as shown in Fig. 4C. Then, a dielectric layer 38 is formed on the entire surface of the glass substrate 30 which includes the transparent electrodes 32, bus electrodes 34, and black masks 36, and then is smoothed, as shown in Fig. 4D. Then, glass cements 40 are formed around the surface of the dielectric layer 38 which is corresponding to the display area of the plasma display panel, as shown in Fig. 4E. Thereafter, as shown in Fig. 4F, an MgO layer 42 is formed on the dielectric layer 38.

Figs. 5A through 5H illustrate another example in which black masks BM are introduced into the front panel of a plasma display panel for improving the dark-room and light-room contrast.

As shown in Fig. 5A, in this example, a glass substrate 50 is provided first. Then, transparent electrodes 52 are formed on the electrodes forming areas on the surface of the glass substrate 50,as shown in Fig.5B. Transparent electrodes 52 are typically made of Indium Tin oxide. Bus electrodes 54 are then formed on the surfaces of transparent electrodes 52, as shown in Fig. 5C. Bus electrodes 54 are

typically formed in a structure of Cr-Cu-Cr or a structure of C-Al-Cr. Then, a dielectric layer 56 is formed on the entire surface of the glass substrate 50 including the transparent electrodes 54, and then is smoothed, as shown in Fig. 5D. Then, black masks 58 are formed on the surface of the dielectric layer 56 which corresponds to the non-luminance area of the plasma non-luminance panel, as shown in Fig. 5E. Black masks 58 are typically made of black glass materials with low melting point. Then, another dielectric layer 60 is formed on the surface of the dielectric layer 56 including the black masks 58, and then is smoothed, as shown in Fig. 5F. Then, glass cements 62 are formed around the surface of the dielectric layer 60 which corresponds to the display area of the plasma display panel, as shown in Fig. 5G. Then, as shown in Fig. 5H, an MgO layer 64 is formed on the dielectric layer 60.

In the above three examples, if the black masks 18, 36, 58 are formed in a structure of Cr-Cu-Cr or a structure of Cr-Al-Cr directly, there may be a surface reflection factor as high as 60%.

Summary of the Invention

Accordingly, it is an object of the present invention to provide a plasma display panel with high contrast and manufacturing method thereof to reduce the surface reflection factor of black masks, and therefore reducing the intensity of reflected light and improving the light-room contrast.

It is another object of the present invention to provide a plasma display panel with high contrast and manufacturing method thereof to form black masks under the bus electrodes, so as to increase the coverage area of the black masks and further reduce the intensity of reflected light in comparison with the conventionally structure.

It is a further object of the present invention to provide a plasma display panel with high contrast and manufacturing method thereof to reduce the intensity of reflected light and improve the light-room contrast without increasing the steps and the cost of the manufacturing process.

To achieve these objects, the present invention provides a manufacturing method of a plasma display panel, comprising the steps of:

(a) providing a glass substrate;

(b) forming a light screening mask on the glass substrate, the light screening mask having a light screening mask top surface;

(c) forming a transparent electrode on the glass substrate adjacent to the light screening mask, the transparent electrode having a side-way extending area which covers the light screening mask top surface;

(d) forming a bus electrode on the sideway extending area of transparent electrodes, such that the bottom surface of the bus electrode is masked by the light screening mask so as to reduce the reflection.

The present invention also provides a manufacturing method of a plasma display panel, comprising the steps of:

(a) providing a glass substrate;

(b) forming a light screening mask on the glass substrate, the light screening mask having a light screening mask sidewall and a light screening mask top surface;

(c) forming a transparent electrode on the glass substrate, the transparent electrode having a transparent electrode sidewall which is adjacent to the light screening mask sidewall and has a height higher than that of the light screening mask sidewall, such that the transparent electrode sidewall has an exposure part;

(d) forming a bus electrode on the light screening mask top surface, wherein, the bus electrode is communicated with the exposure part of the transparent electrode sideway, such that the bottom surface of the bus electrode is masked by the light screening mask so as to reduce the reflection.

The present invention further provides a manufacturing method of a plasma display panel, comprising the steps of:

(a) providing a glass substrate;

(b) forming a light screening mask on the glass substrate, the light screening mask having a light screening mask sidewall and a light screening mask top surface;

(c) forming a transparent electrode on the glass substrate, the transparent electrode having a transparent electrode sidewall and a transparent electrode top surface, and the transparent electrode sidewall being adjacent to the light screening mask sidewall;

(d) forming a bus electrode on the light screening mask top surface and a part

of the transparent electrode top surface, wherein, the bus electrode is communicated with the part of the transparent electrode top surface, such that the bottom surface of the bus electrode is masked by the light screening mask so as to reduce the reflection.

The present invention also provides a plasma display, comprising a glass substrate, a transparent electrode and a bus electrode, wherein, the transparent electrode is formed on the glass substrate, and the bus electrode is communicated with the transparent electrode; a light screening mask is formed between the bus electrode and the glass substrate such that the bottom surface of the bus electrode is masked by the light screening mask so as to reduce the reflection.

The advantages of the present invention is that the plasma display panel according to the above method is that black masks will be formed to cover both on the non-luminance area and under the electrode forming area, so as to increase the coverage area of the black mask and thereby reduce the intensity of reflected light and improve the light-room contrast in comparison with the conventional structure.

Brief Description of the Drawings

In order to make the above and other objects, features and advantages of the present invention apparent, a preferred embodiment will be illustrated in combination with the accompanying drawings, in which:

Fig.1A is a structure diagram of three electrodes in a conventional plasma display panel;

Fig.1B is diagram for the surface discharge status of the plasma display panel as shown in Fig. 1A;

Fig.2 is a schematic diagram for the contrast of a plasma display panel;

Figs.3A through 3G are the manufacturing flow chart in which black masks are introduced into the front panel of a plasma display panel for improving the light-room contrast;

Figs.4A through 4F are another manufacturing flow chart in which black masks are introduced into the front panel of a plasma display panel for improving the light-room contrast;

Figs.5A through 5H are another manufacturing flow chart in which black

masks are introduced into the front panel of a plasma display panel for improving the light-room contrast;

Figs. 6A through 6F are manufacturing flow chart of a first embodiment of a plasma display panel according to the present invention;

Figs. 7A through 7C are manufacturing flow chart of a second embodiment of a plasma display panel according to the present invention;

Figs. 8A through 8C are manufacturing flow chart of a third embodiment of a plasma display panel according to the present invention;

Detailed Description of the Preferred embodiments

Considering the fact that the surface reflection factor of black masks may influence the light-room contrast directly, the present invention utilizes black masks formed in a structure of Cr/Cr_2O_3 or a structure of Fe/Fe_2O_3. Compared with the conventional black masks formed in a structure of Cr/Cu/Cr or a structure of Cr/Al/Cr, the surface reflection factor of the black masks according to the present invention may be kept below 20%.

Figs. 6A through 6F are manufacturing flow chart of a first embodiment of a plasma display panel according to the present invention,

First, as shown in Fig. 6A, a glass substrate 70 is provided, and a black mask layer 72 is formed on the surface of the glass substrate 70. In this embodiment, the black mask layer 72 may be formed by sputtering a Cr/Cr_2O_3 structure or a Fe/Fe_2O_3 structure of 1K - 2KÅ sequentially on the surface of the glass substrate 70.

Next, as shown in Fig. 6B, a photoresist layer 74 is defined on the black mask layer 72. An area A for forming light screening masks 73 and an area B for black masks 75 are exposed using a photomask in the semiconductor manufacturing process, so as to harden the photoresist 74 corresponding to the areas A and B. The photoresist in the area other than the areas A and B is then removed in a developing step. Next, as shown in Fig. 6C, by using the photoresist 74 as a mask and Cr-7 as the Etchant, the mask layer 72 which is not protected by the residual photoresist 74 is etched such that only the light screening masks 73 in the area A and the black masks 75 in the area B are left, wherein, the light screening masks 73 have a light screening mask top surface

77. A preferred embodiment has been described in detail here, in which light screening masks 73 and black masks 75 are formed simultaneously. However, in an alternate implementation, light screening masks 73 can be formed first in this step, with black masks 75 formed later via an additional photomask in a lithography step.

Next, as shown in Fig. 6D, a layer of transparent electrode 76 is formed on the surface of the light screening masks 73 which is formed on the electrode forming area A on the surface of a plasma display panel. The transparent electrode 76 has a sideway extending area 79 which covers the light screening mask top surface 77. In this embodiment, the transparent electrode 76 can be formed by sputtering a layer of Indium Tin Oxide (ITO) with a thickness of about 1500 Å on the black mask 75 and the light screening mask 73 which have been patterned, defining the layer of Indium Tin Oxide via a lithography step (such as exposing, developing, etching, which may be performed by using the FeCl3+HCl as the etchant); and removing the Indium Tin Oxide on the surface of the black mask 75.

Next, as shown in Fig. 6E, a bus electrode 78 is formed on the sideway extending area 79 of the transparent electrode 76, such that the bottom surface 81 of bus electrode 78 may be masked by the light screening masks 73 to reduce the reflection. In this embodiment, the bus electrode may be formed by sputtering a Cr layer 78a with a thickness of about 1K~2KÅ, a Cu (A1) layer 78b with a thickness of about 2~3 μ m, and a Cr layer 78c with a thickness of about 1K~2KÅ sequentially over the transparent electrode 76 corresponding to the light screening mask 73, and etching the three layers of metal 78a ~ 78c via a lithography step so as to forming the desired bus electrode 78 on the surface of the transparent electrode 76. .

Next, as shown in Fig. 6F, a dielectric layer 80 (such as lead oxide and silicon oxide) of about 30 μ m covers the black masks 75, the transparent electrodes 76, the light screening masks 73, and the bus electrodes 78. Thereafter, a protective layer 82 (such as a magnesium oxide layer) of about 5000~10000 Å is deposited over the surface of the dielectric layer 80, so as to complete the entire structure of the plasma display.

The first three steps in the manufacturing process of the second embodiment of the plasma display panel according to the present invention are the same as those of

the first embodiment shown in Figs.6A through 6C. However, Figs. 6D through 6F are modified into Figs. 7A through 7C.

As shown in Fig. 7A, the light screening mask 73 on the surface of the glass substrate 70 has a light screening mask sidewall 85 and a light screening mask top surface 87. In this case, a transparent electrode 76 is formed on the glass substrate 70. The transparent electrode 76 has a transparent electrode sidewall 91. The transparent electrode sidewall 91 is adjacent to the light screening mask sidewall 85, and has a height higher than that of the light screening mask sidewall 85, such that the transparent electrode sidewall 91 has an exposure part 93. The manufacturing process and condition for the transparent electrode 76 in this step are similar to those in the first embodiment as shown in Fig.6D.

Next, as shown in Fig. 7B, a bus electrode 78 is formed on the light screening mask top surface 87, The bus electrode 78 is communicated with the exposure part 93 of the transparent electrode sidewall 91, such that the bottom surface 81 of the bus electrode is masked by the light screening mask 73 to reduce the reflection. The manufacturing process and condition for the bus electrode 78 in this step are similar to those in the first embodiment as shown in Fig. 6E.

Next, as shown in Fig. 7C, a dielectric layer 80 covers the transparent electrode 76, the light screening mask 73, the black mask 75, and the bus electrode 78. A protective layer 82 is further deposited over the surface of the dielectric layer 80. The manufacturing process and condition in this step are similar to those in the first embodiment as shown in Fig. 6F.

The first three steps in the manufacturing process of the second embodiment of the plasma display panel according to the present invention are the same as those of the first embodiment shown in Figs.6A through 6C. However, Figs 6D through 6F are modified into Figs 8A through 8C.

As shown in Fig. 8A, the light screening mask 73 on the surface of the glass substrate 70 has a light screening mask sidewall 85 and a light screening mask top surface 87. In this case, a transparent electrode 76 is formed on the glass substrate 70. The transparent electrode 76 has a transparent electrode sidewall 91 and a transparent electrode top surface 95. The transparent electrode sidewall 91 is adjacent to the light

screening mask sidewall 85. The manufacturing process and condition for the transparent electrode 76 in this step are similar to those in the first embodiment as shown in Fig.6D.

Next, as shown in Fig. 8B, a bus electrode 78 is formed on the light screening mask top surface 87 and a part of the transparent electrode top surface 95. The bus electrode 78 is communicated with a part of the transparent electrode top surface 95, such that most of the bottom surface 81 of the bus electrode is masked by the light screening mask 73 to reduce the reflection. The manufacturing process and condition for the bus electrode 78 in this step are similar to those in the first embodiment as shown in Fig. 6E.

Next, as shown in Fig. 8C, a dielectric layer 80 covers the transparent electrode 76, the light screening mask 73, the black mask 75, and the bus electrode 78. A protective layer 82 is further deposited on the surface of the dielectric layer 80. The manufacturing process and condition in this step are similar to those in the first embodiment as shown in Fig. 6F.

In general, the present invention provides a plasma display panel with high contrast and manufacturing method thereof, which may reduce the surface reflection factor of black masks and thereby reducing the intensity of reflected light and improving the light-room contrast.

Additionally, the present invention provides a plasma display panel with high contrast and manufacturing method thereof, which arranges black masks both on the non-luminance area and under the bus electrode so as to increase the coverage area of the black masks, and thereby reducing the intensity of reflected light in a plasma display panel in compared with the conventional structure.

Furthermore, the present invention provides a plasma display panel with high contrast and manufacturing method thereof, for reducing intensity of reflected light and improving the light-room contrast without increasing the steps and the cost of the manufacturing process.

What is claimed is:

1. A manufacturing method of a plasma display panel, comprising the steps of:

(a) providing a glass substrate;

(b) forming a light screening mask on the glass substrate, the light screening mask having a light screening mask top surface;

(c) forming a transparent electrode on the glass substrate adjacent to the light screening mask, the transparent electrode having a sidesway extending area which covers over the light screening mask top surface;

(d) forming a bus electrode on the sideway extending area of the transparent electrode, such that the bottom surface of the bus electrode is masked by the light screening mask to reduce the reflection.

2. The manufacturing method of a plasma display panel according to claim 1, wherein, in the step (b), a black mask for insulating different image pixels on the glass substrate is formed on the glass substrate simultaneously.

3. The manufacturing method of a plasma display panel according to claim 1, wherein, following the step (d), further comprising a step: (e) forming a dielectric layer to cover the glass substrate, the light screening mask, the transparent electrode and the bus electrode.

4. The manufacturing method of a plasma display panel according to claim 3, wherein, following the step (e), further comprising a step: (f) forming a protective layer over the surface of the dielectric layer.

5. A manufacturing method of a plasma display panel, comprising the steps of:

(a) providing a glass substrate;

(b) forming a light screening mask on the glass substrate, the light screening mask having a light screening mask sidewall and a light screening mask top surface;

(c) forming a transparent electrode on the glass substrate, the transparent

electrode having a transparent electrode sidewall adjacent to the light screening mask sidewall, and the height of the transparent electrode sidewall being higher than that of the light screening mask sidewall such that the transparent electrode sidewall has a exposure part;

(d) forming a bus electrode on the light screening mask top surface, wherein, the bus electrode is communicated with the exposure part of the transparent electrode, such that the bottom of the bus electrode is masked by the light screening mask to reduce the reflection.

6. The manufacturing method of a plasma display panel according to claim 5, wherein, in the step (b), a black mask for insulating different image pixels on the glass substrate is formed on the glass substrate simultaneously.

7. The manufacturing method of a plasma display panel according to claim 5, wherein, following the step (d), further comprising a step: (e) forming a dielectric layer to cover the glass substrate, the light screening mask, the transparent electrode and the bus electrode.

8. The manufacturing method of a plasma display panel according to claim 7, wherein, following the step (e), further comprising a step: (f) forming a protective layer over the surface of the dielectric layer.

9. A manufacturing method of a plasma display panel, comprising the steps of:

(a) providing a glass substrate;

(b) forming a light screening mask on the glass substrate, the light screening mask having a light screening mask sidewall and a light screening mask top surface;

(c) forming a transparent electrode on the glass substrate, the transparent electrode having a transparent electrode sidewall and a transparent electrode top surface, and the transparent electrode sidewall being adjacent to the light screening mask sidewall;

(d) forming a bus electrode on the light screening mask top surface and a part of the transparent electrode top surface, wherein, the bus electrode is communicated

with the part of the transparent electrode top surface, such that the bottom of the bus electrode is masked by the light screening mask to reduce the reflection.

10. The manufacturing method of a plasma display panel according to claim 9, wherein, in the step (b), a black mask for insulating different image pixels on the glass substrate is formed on the glass substrate simultaneously.

11. The manufacturing method of a plasma display panel according to claim 9, wherein, following the step (d), further comprising a step: (e) forming a dielectric layer to cover the glass substrate, the light screening mask, the transparent electrode and the bus electrode.

12. The manufacturing method of a plasma display panel according to claim 11, wherein, following the step (e), further comprising a step: (f) forming a protective layer over the surface of the dielectric layer.

13. A plasma display panel comprising a glass substrate, a transparent electrode and a bus electrode, wherein the transparent electrode is formed on the glass substrate, and the bus electrode is communicated with the transparent electrode, and characterizing in that

a light screening mask is formed between the bus electrode and the glass substrate such that the bottom surface of the bus electrode is masked by the light screening mask to reduce the reflection.

14. The plasma display panel according to claim 13, wherein, the light screening mask has a light screening mask top surface; the transparent electrode has a sideway extending area which covers the light screening mask top surface; and, the bus electrode is arranged on the sideway extending area of the transparent electrode.

15. The plasma display panel according to claim 13, wherein, the light screening mask has a light screening mask sidewall and a light screening mask top surface; the transparent electrode has a transparent electrode sidewall which is adjacent to the light screening mask sidewall and has a height higher than that of the light screening mask sidewall; the bus electrode is formed on the light screening mask top surface, such that the transparent electrode sidewall has a exposure part; and, the

bus electrode is communicated with the exposure part of the transparent electrode sidewall.

16. The plasma display panel according to claim 13, wherein, the light screening mask has a light screening mask sidewall and a light screening mask top surface; the transparent electrode has a transparent electrode sidewall which is adjacent to the light screening mask sidewall and has a height higher than that of the light screening mask sidewall; the bus electrode is formed on the light screening mask and a part of the transparent electrode; and the bus electrode is communicated with a part of the transparent electrode top surface.

17. The plasma display panel according to claim 13, wherein, the light screening mask has a structure of Cr-Cr2O3.

18. The plasma display panel according to claim 13, wherein, the light screening mask has a structure of Fe-Fe203.

19. The plasma display panel according to claim 13, wherein, the light screening mask is made of the black glass material with low melting point.

20. The plasma display panel according to claim 13, wherein, the bus electrode has an Ag structure.

21. The plasma display panel according to claim 20, wherein, the dielectric layer is made of the materials of lead oxide and silicon oxide.

22. The plasma display panel according to claim 20, further comprising a protective layer that is formed on the surface of the dielectric layer.

23. The plasma display panel according to claim 22, wherein, the protective layer is MgO.

Fig.1A

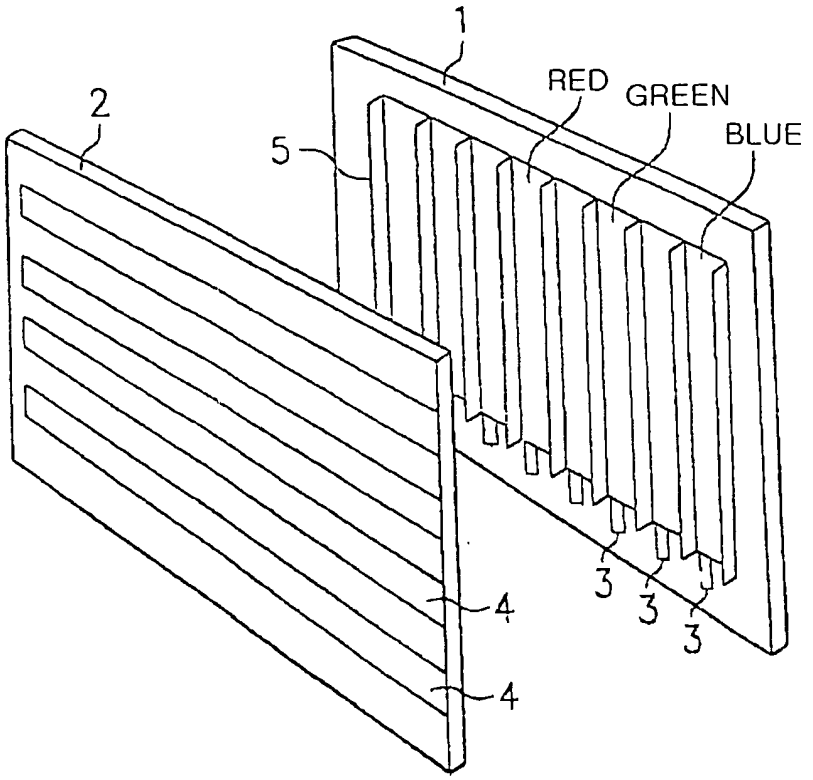

Fig.1B

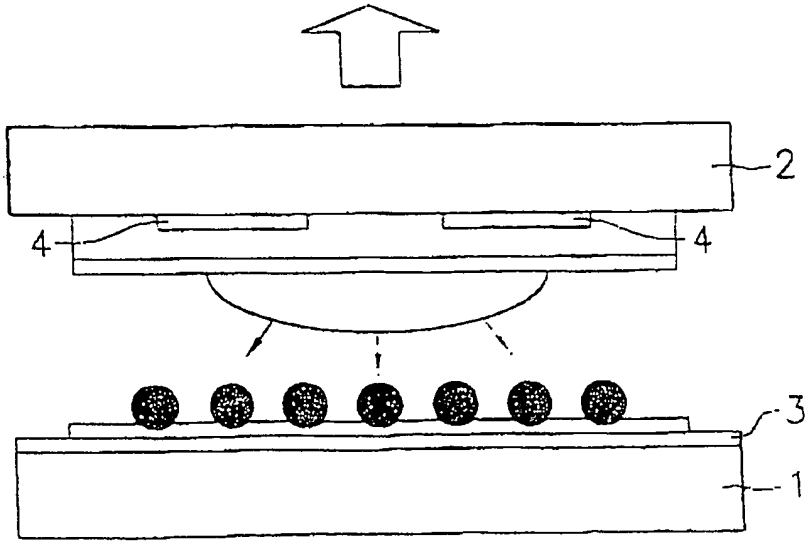

Fig.2

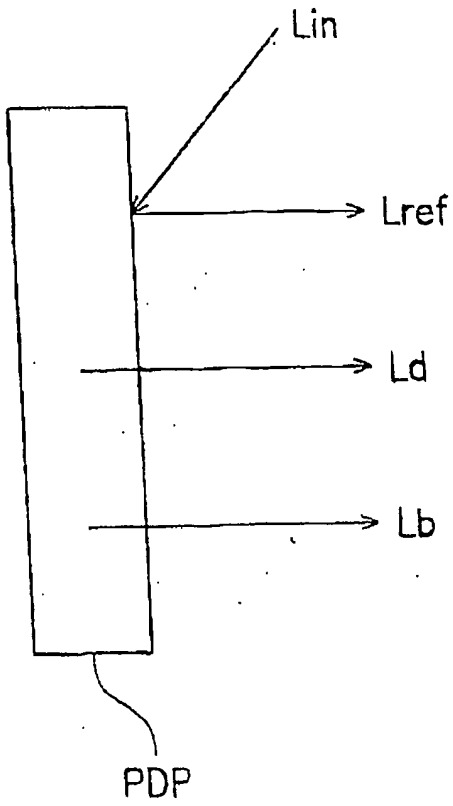

Fig.3A

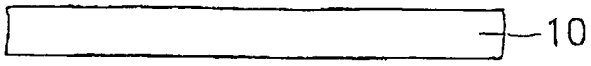

Fig.3B

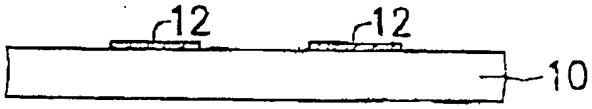

Fig.3C

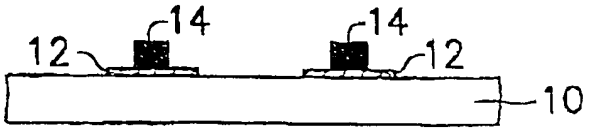

Fig.3D

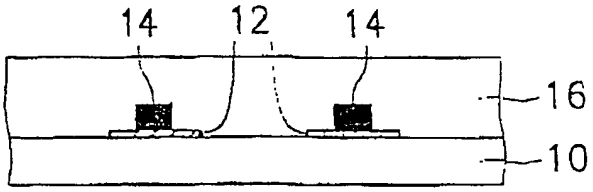

Fig.3E

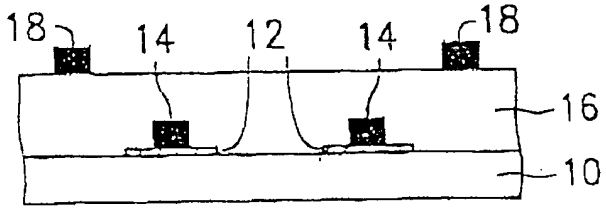

Fig.3F

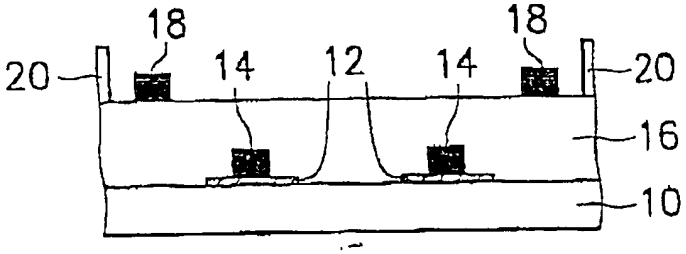

Fig.3G

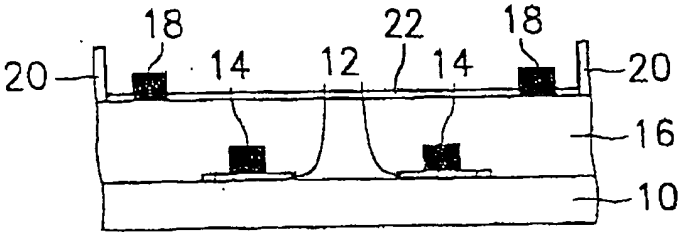

Fig.4A

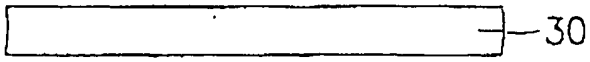

Fig.4B

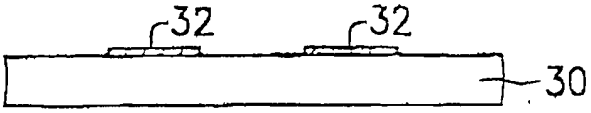

Fig.4C

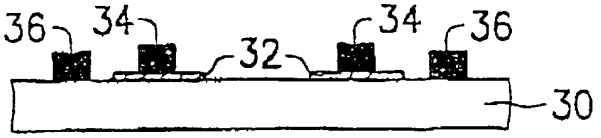

Fig.4D

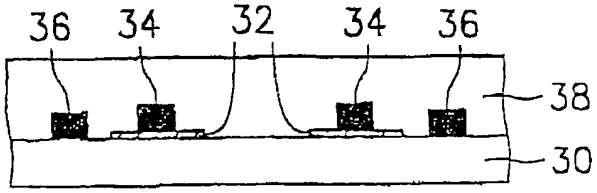

Fig.4E

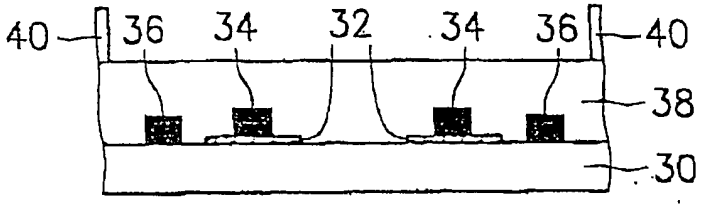

Fig.4F

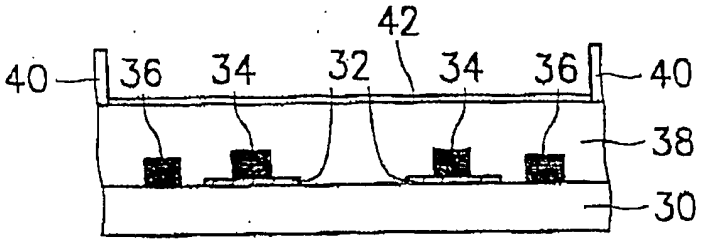

Fig.5A

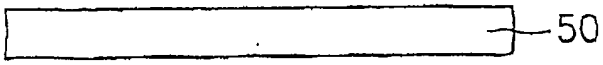

Fig.5B

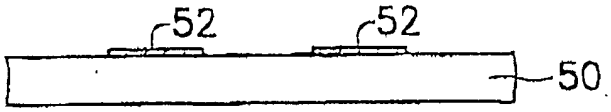

Fig.5C

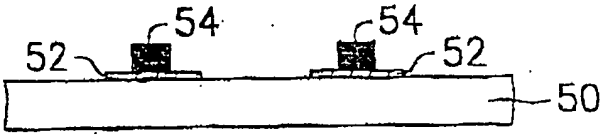

Fig.5D

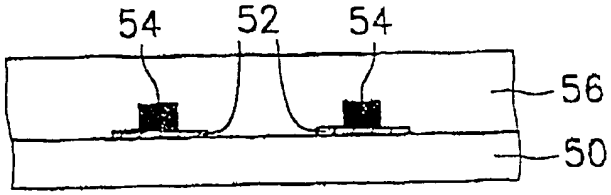

Fig.5E

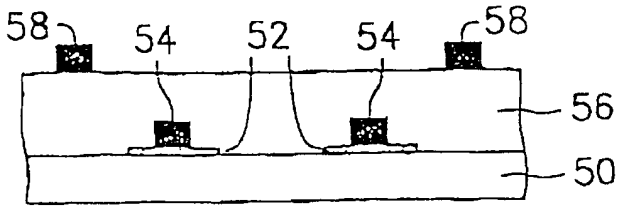

Fig.5F

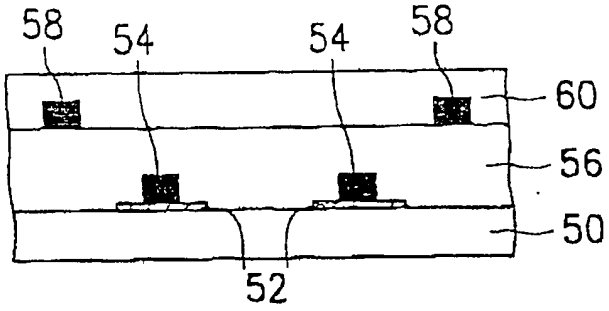

Fig.5G

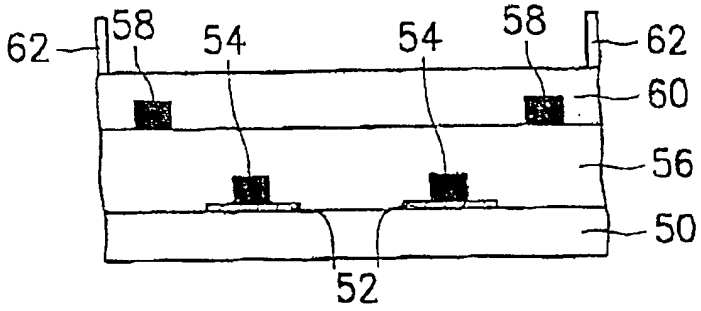

Fig.5H

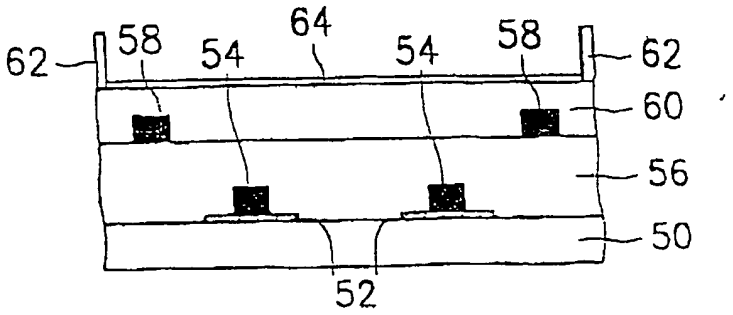

Fig.6A

Fig.6B

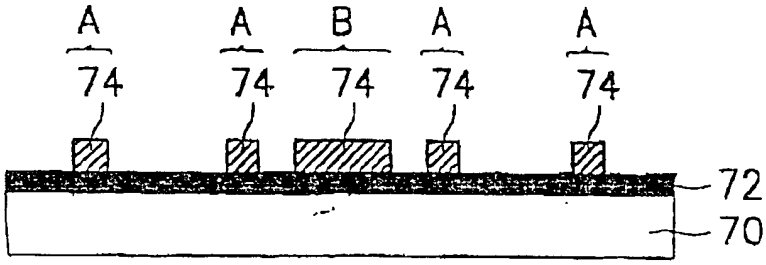

Fig.6C

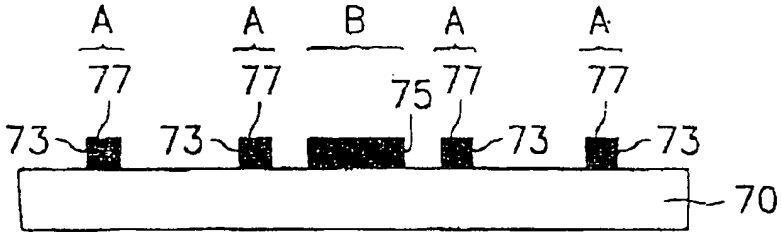

Fig.6D

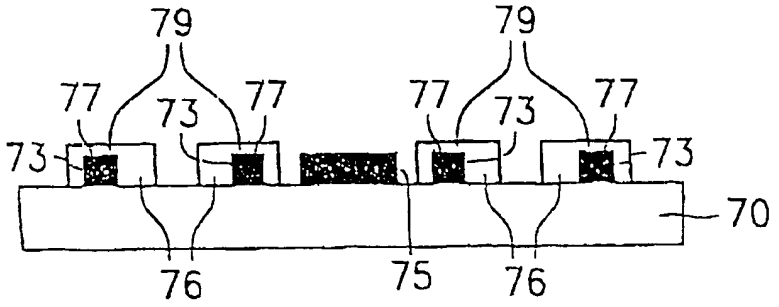

Fig.6E

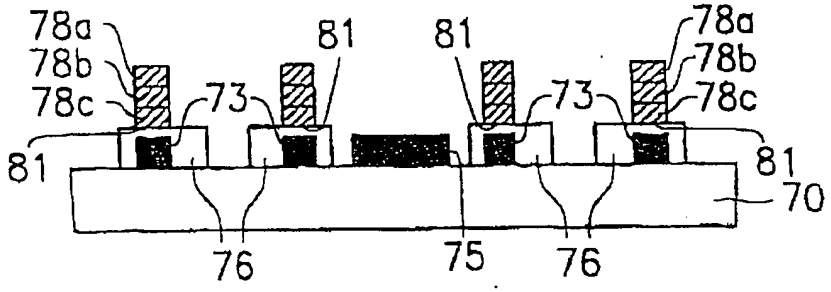

Fig.6F

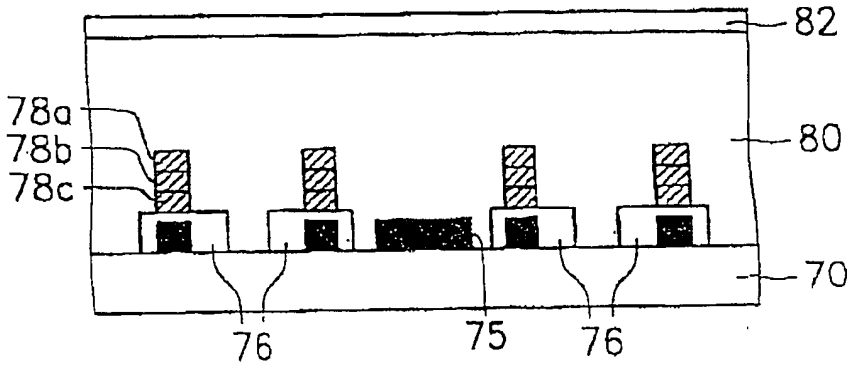

Fig.7A

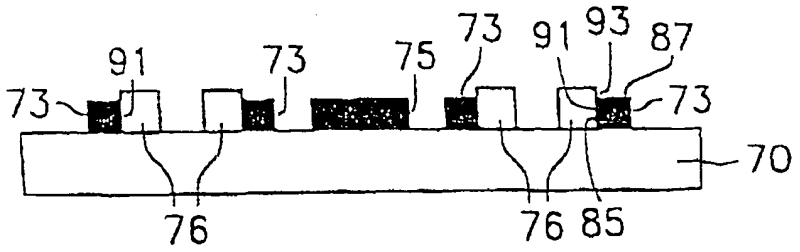

Fig.7B

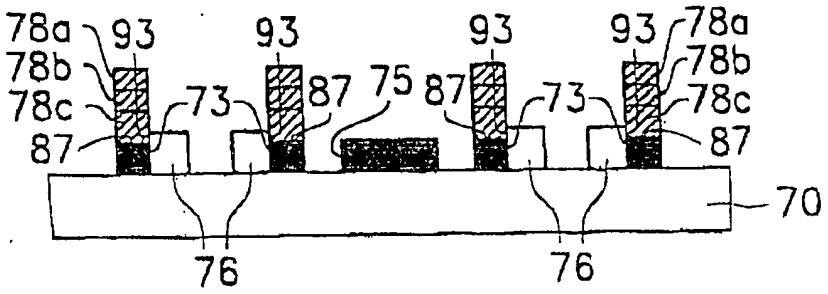

Fig.7C

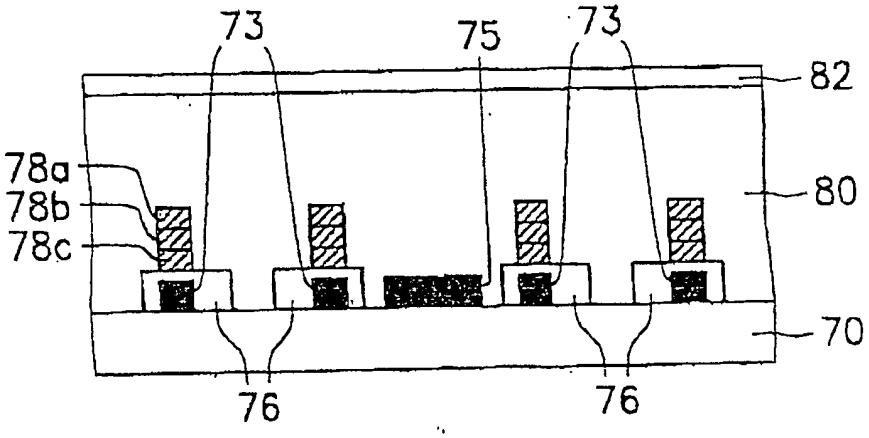

Fig.8A

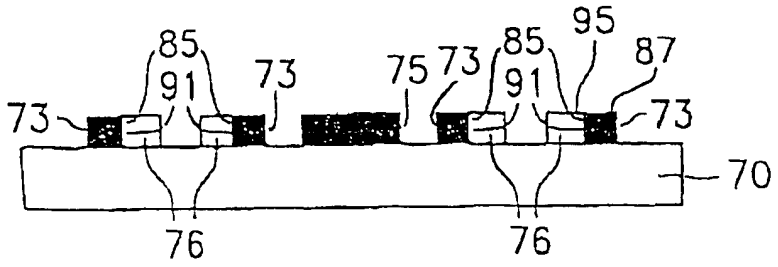

Fig.8B

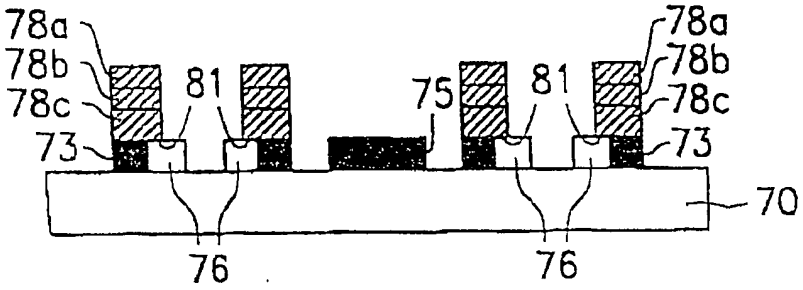

Fig.8C